

Claims

[c1] What is claimed is:

1.A method of forming a gate structure comprising:
providing a substrate having at least a stacked gate, the stacked gate comprising a gate insulating layer, a polysilicon layer, a silicate layer, and a cap layer;
depositing a sacrificial layer on the stacked gate;
etching back the sacrificial layer to expose the cap layer and an upper portion of the silicate layer;
removing a portion of the exposed silicate layer to form a recess;
removing the sacrificial layer;
filling a silicon nitride layer into the recess; and
forming a spacer on walls of the stacked gate.

[c2] 2.The method of claim 1 wherein the cap layer is composed of silicon nitride.

[c3] 3.The method of claim 1 wherein the silicate layer is composed of silicon tungsten.

[c4] 4.The method of claim 1 wherein the recess is formed by an anisotropic etching process.

- [c5] 5.The method of claim 1 wherein steps of filling the silicon nitride layer into the recess further comprises:
depositing a silicon nitride layer on the substrate to fill up the recess; and
performing an etching process to remove silicon nitride layer outside the recess.
- [c6] 6.The method of claim 1 wherein steps of forming the spacer further comprises:
depositing a spacer layer on the stacked gate; and
performing an etching process to remove parts of the spacer layer for forming a spacer on walls of the stacked gate.
- [c7] 7.The method of claim 6 wherein the spacer layer is composed of silicon nitride.
- [c8] 8.A method of forming a gate structure comprising:
providing a substrate having at least two stacked gates, each stacked gate comprising a gate insulating layer, a polysilicon layer, a silicate layer, and a cap layer;
depositing a sacrificial layer on the substrate between the stacked gates;
etching back the sacrificial layer to expose the cap layer and an upper portion of the silicate layer;
removing a portion of the exposed silicate layer to form a recess;

removing the sacrificial layer;
depositing a silicon nitride layer to fill up the recess; and
removing parts of the silicon nitride layer for forming a
spacer on walls of the stacked gate.

[c9] 9.The method of claim 8 after forming the spacer further
comprising:

depositing a barrier layer on the substrate;
depositing a borophosphosilicate glass (BPSG) layer on
the barrier layer;
performing a flow process for planarizing the BPSG layer;
performing a chemical mechanical polishing (CMP) pro-
cess for removing the BPSG layer over a top surface of
the cap layer;
depositing a dielectric layer on the cap layer and the
BPSG layer; and
removing parts of the dielectric layer, the BPSG layer, and
the barrier layer to form a contact hole between the
stacked gates.

[c10] 10.The method of claim 9 wherein the barrier layer is
composed of silicon nitride.

[c11] 11.The method of claim 9 wherein the dielectric layer is
composed of tetra-ethyl-ortho-silicate (TEOS).

[c12] 12.The method of claim 8 wherein the silicate layer is

composed of silicon tungsten.

[c13] 13.The method of claim 8 wherein the recess is formed by an anisotropic etching process.

[c14] 14.The method of claim 8 wherein cap layer is composed of silicon nitride.